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"DAIRY WASTEWATER TREATMENT USING COCONUT SHELL ACTIVATED CARBON & LATERITE AS LOW COST ADSORBENTS"

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ABSTRACT

The main aim of this is the assessments of reduction of chemical oxygen demand (COD) & biological oxygen demand (BOD) from dairy wastewater using low cost adsorbents like coconut Shell Activated Carbon (CSAC) & laterite in Fix Bed Stationary Phase. The other parameters like viscosity, specific gravity. Total suspended solids, pH are effectively reducing by Mixed Bed Stationary Phase of different ratios.

Treatment efficiencies of Fixed Bed Stationary Phase adsorbents of different ratios are compared. The complete study was done in Column Chromatography to investigate the effect of operating parameter. The result of before and after treatment is compared & optimum operating conditions were determined for maximum reduction

The mixed bed stationary phase Coconut Shell Activated Carbon (CSAC) & laterite reduced COD upto 72.85% & BOD reduces upto 76.75% in 1:1 ratio & 2:1ratio of CSAC to laterite, COD reduces upto 75.3% & BOD reduces upto 79.69% & finally 1:2 ratio of CSAC to laterite, COD reduces upto 80.65% & BOD reduces upto 81.09%, this is the maximum reduction in the COD & BOD concentration from effluent of dairy processing plant. It could be lucrative technique for treatment of dairy wastewater generated in different sectors.

KEYWORDS: Chemical Oxygen Demand (COD), Coconut Shell Activated Carbon (CSAC), Laterite Reduced COD

INTRODUCTION

General Introduction

Milk is an important component of food all over the world Paticularly in India milk and milk product are considered to be essential constituent of food. From veda times cow is called "Gomata" "Kamdenu"

- 2 Objectives of Study
- Enviromental polluction control of dairy waste water.
- Removing of organic matter by adsorption techniques & reduction of B.O.D.,C.O.D., increase of pH of natural water.
- To achieve the above
- Use of locally available adsorbent materials which are low cost & easily available.
- Procedure adopted should be simple & industries (dairy) are affected to use this technique for wastewater treatment.
- Cost involved should be minimum

- Space requirement for the process should be as less as possible & without much infrastructure requirement.
- Treated wastewater should as good as normal water. So that it will not be affect environment & ecosystem.
- The process should not be pose new problem for industry.

MATERIAL & METHODS

Experimental Setup

In the study of present work, an adsorption study with coconut shell activated carbon & laterite is done on wastewater to optimize conditions to be applied to dairies.

- Ratio of stationary phase material
- Flow rate
- Temperature
- pH

For the column chromatography experimentation following experiment set up is used Acrylic pipe of 70 cm height & diameter 6.4cm is having top inlet tap is there to entry of wastewater in ratio 1:1 of CSAC to laterite is 6min interval of five run & in ratio 1:2 of CSAC to laterite is 3min interval for five run & finally in ratio 2:1 CSAC & laterite is 5 min interval of five run & a bottom outlet tap is to collect treated wastewater as shown in figure.

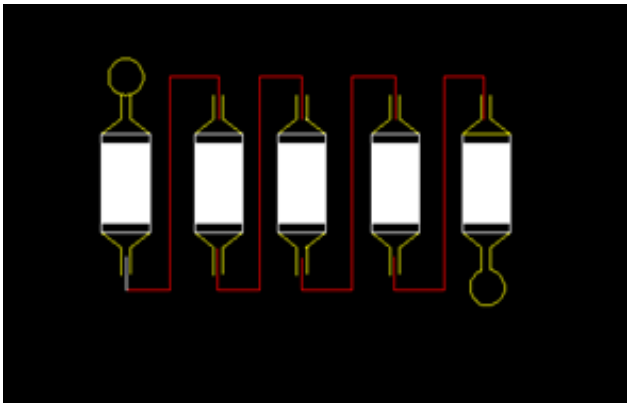


Figure 1

Material Used

In the study the following two material is used as adsorbents

- Coconut shell activated carbon (CSAC)
- Laterite

Preparation of Activated Carbon from Coconut Shell

Coconut shell has advantages compared to material because of its ability to adsorb colour or aroma. Generally, coconut production at farmer level is 1ton/Ha, with the coconut shell by product of 0.9ton, which in turn can yield 0.36ton of activated charcoal. coconut shells are collected locally from farmer into heap in open space.mud is put over that provision made for

- Firing the the bottom
- Exhaust made putting 3 to 4 pipes on top

Image of Activated Carbon

Figure 2

Preparation of Laterite

Laterite is ared-coloured clay-rich soil found in the tropical & subtropics. In present study we has selected a locally available low cost laterite used for treatment purpose. The laterite used is collected from Babsaheb Ambedkar agricultural center, Dapoli, Maharastra, India. Before its use as adsorbent ,soil was thoroughly with the water of tap to remove the unwanted material such as decomposed organic matter, worm, sand dust particles, etc. & iron containing fine particles & dried in the sun for 2-3 days . Then it is crushed to make adsorbent in different size range 1mm, 2mm. these are the sieved, washed thoroughly (15-20 times) with the large volume of tap water to remove red colour of iron & finally washed with distilled water. Lastly, the material is dried overnight in hot air oven at 110°C. The as prepared particles are used for acidic adsorption.

Sampling & Preservation of Effluent

For analysis the sample is collected in a clean air tight plastic container of five liter capacity, & the sample are collected twice in the week & far as possible fresh samples are used for analysis & some times samples are preserved in refrigerator at 4°C & while using preserved sample first it is bring back to the ambient room temperature & then used for analysis. The wastewater is filtered to remove suspendeed solid particles; the filtered wastewater is used in column chromatography & laboratory investigation.

Optimization of Various Operating Parameters

Optimization of Ratio

To optimize the ratio of column material, column material is prepared with different ratio to act as a mixed bed material (1:1, 1:2, 2:1 of CSAC: Laterite)

Optimization of Surface Area

Criteria for selecting particle size is to maintain the flow rate of effluent is 5min at the same time effective removal of pollutants is alsom kept in mind. Various particle size 0.1mm to 2mm tried. The most suitable size was chosen though as per theory increase the adsorption but to compromise between adsorption & out of flow rate, experimental set up is made to carry out the project with 1mm diameter size particle.

Optimization of Contact B Time

The adsorption process is strongly influenced by contact time. For the study of effect of contact time of 1000ml of wastewater from dairy in column chromatography .there is variation in flow time & it is found to be 1m/5min approximately. In tnis column chromatography the effective treatment obtained from 1:2 (CSAC: laterite) ratio.

Temperature: all the chemicals are used out at ambient temperature (27.5°C±2.5°C) in column chromatography method.

Chemical Used

All chemicals used are of ANALAR samples.

Analytical Methods

Thye procedure followed for the analysis of various quality parameters are as per 'standard method' for examination of water & wastewater (1998)

METHODOLOGY

Procedure followed by the treatment of wastewater is by column chromatography.

The stationary phase materials namely Coconut Shell Activated Carbon (CSAC) & laterite are taken in different ratio by weight of CSAC is much less compared to laterite. Number of particles in half of kg of CSAC is much more compared to laterite. i.e. surface area for adsorption by CSAC is more than laterite.

All the experiments are carried out at ambient room temperature. The column chromatography is conducted in 5 different columns of 1 m height & diameter (6.4cm). Columns are run in different ratio of CSAC & Laterite as a stationary phase for all the experimental conditions like pH, viscosity, COD, specific gravity, & total suspended solids of solution. The influences of various operating parameters are studying by varying ratio of adsorbents CSAC & laterite.

Surface area of adsorbents namely CSAC & laterite are choosen, considering the rate of flow of waste water. CSAC & laterite particles size to be 1mm, which gave satisfactory out flow of wastewater at rate (0.2m/min). When the ratio by weight 2:1(CSAC: Laterite).

Column prepared, using mixed bed material (about 1m height) & wastewater ran (1 lt), samples collected at different intervals of time. Different parameters are determined .Result obtained are tabulated.

RESULTS

Table 1: Average Characteristics of Raw & Treated Waste Water at Optimum Operating Parameters

Sr No.	Particulars	Raw Waste Water	Treated Waste water		
			1:1	1:2	2:1
1	Colour	light milky	clear	Clear	clear
2	Odour	bad smell	absent	Absent	absent
3	total suspened solids	375	80	60	70
4	COD(mg/l)	1344	365	260	332
5	Viscosity	6.21	8.9	9.75	9.34
6	specific gravity	0.62	0.85	0.95	0.91
7	pH	5.1	6.92	7.63	7.23
8	BOD	645	150	122	131

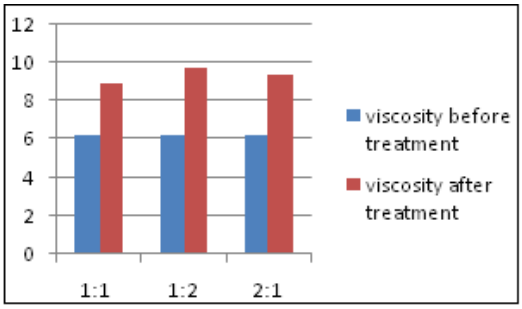
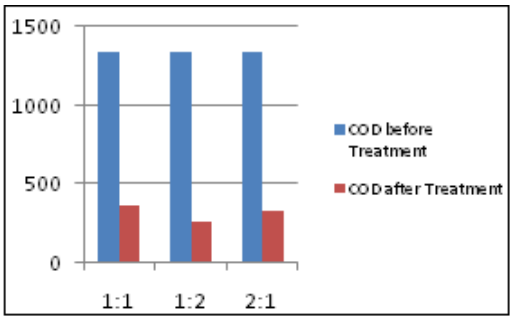


Figure 3



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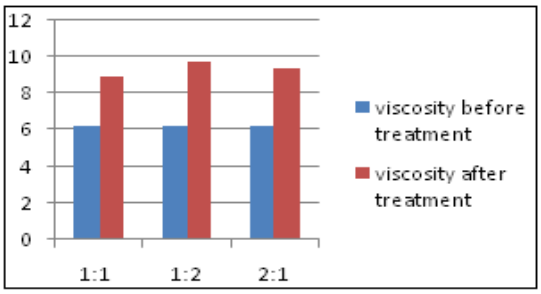

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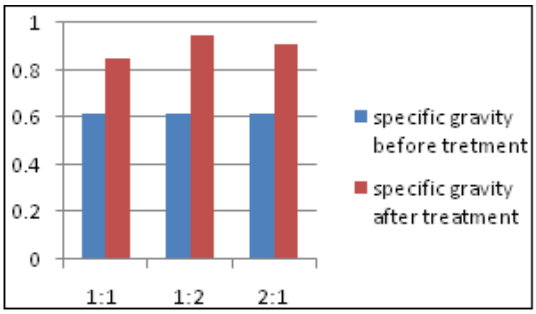

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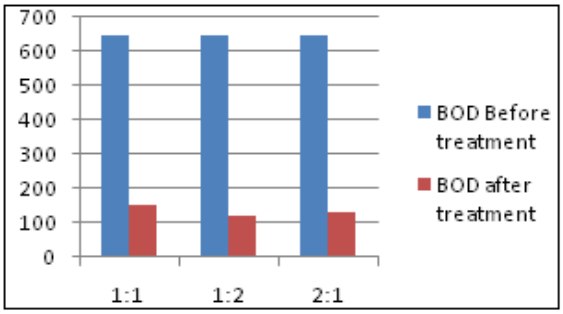

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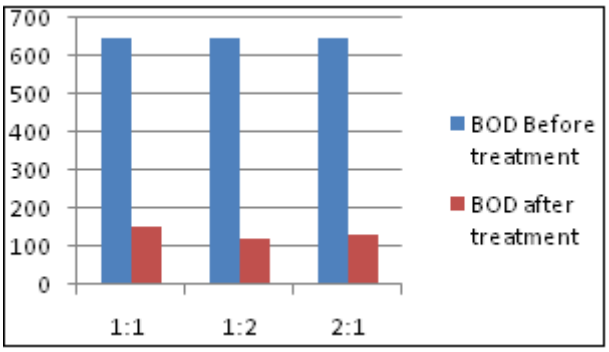

Figure 8

CONCLUSIONS

From the experimental investigation in treatment of dairy wastewater using CSAC & laterite as low cost, easily available adsorbents. following conclusions are drawn

The coconut shell activated carbon (CSAC) as good adsorbing capacity for neutral & basic components of waste water. laterite is acidic in nature, it can adsorb all the acidic impurities.

The cost analysis of the preparation of CSAC & laterite has not be done since both are available abundantly & can be obtained for nominal price as agricultural by products.

Fixed bed stationary phase in different ratios (1:1,1:2,2:1) tried for the first time & CSAC & laterite adsorb all basic & acidic impurities effectively which is very much shown when the ratio of CSAC to laterite is 1:2.

The mixed bed stationary phase of CSAC & laterite reduces COD upto 80.65% & BOD upto 81.09%

And other parameters like pH,COD BOD viscosity total susoended solids are effectively reduced by mixed stationary bed of CSAC & laterite (1:2) ratio.

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